REMARKS

Claims 1-12 and 14-17 were rejected under 35 U.S.C. §102(b) as being anticipated by US patent application publication 2002/0072671 (Chenal et al.) which was cited by the applicant. Amended Claim 1 describes a method for ultrasonically measuring the volume of a volumetric object of a body such as the heart in real time comprising repetitively acquiring ultrasonic images of the heart during a heart cycle in two intersecting image planes at substantially the same time with an ultrasound probe; using an automated processor to define corresponding object borders in the ultrasonic images during the heart cycle; producing a plurality of quantified measures of the volume of the heart during the heart cycle from the defined object borders; and displaying the plurality of quantified measures of the volume of the heart. An embodiment of the present invention enables the volume of a heart chamber to be continuously measured and displayed in real time as shown in Fig. 12 of the present application. Using a biplane probe pairs of intersecting image planes are continuously acquired during a heart cycle. As the pairs of image planes are acquired an automated processor defines the heart chamber borders during the heart cycle. The defined border are used to produce a plurality of volume measures of the heart chamber during the heart cycle which are displayed. As explained on page 14 of the present application, a physiologic curve of the continuously changing chamber volume during the heart cycle can be presented as a scrolling, real time display to show the clinician the cyclic changes in heart volume as the heart beats.

The methods of Chenal et al. do not produce measures of the volume of the heart in real time called for by Claim 1, nor do they produce those measures during the heart cycle of image acquisition so as to be in real time, nor do they acquire two intersecting planes of the heart at substantially the same time, all as called for by the present claim. It is seen throughout the Chenal et al. application that they refer to acquiring "loops", which are sequences of images acquired during a heart cycle which are then saved in Cineloop memory 460 by pressing the "Freeze" button on the ultrasound system. See paragraph [0024] of Chenal et al. Once a loop of images has been captured and saved, it can then be operated on by the ABD processor 490 to define borders in the images. This is a post-processing approach and not one which operates in real time to produce heart volume measurements during the heart cycle of image acquisition.

Chenal et al. also do not acquire two intersecting planes simultaneously as called for by Claim 1. The Examiner points to paragraph [0056] of Chenal et al. for this capability,

but it is seen that this paragraph actually describes a multiplanar reconstruction (MPR) technique. In MPR, a volume of data is acquired one plane at a time and stored in the system as described at the outset of paragraph [0055]. Once this static block of image data has been assembled, an image of any plane through the volume can be produced simply by addressing data points which are in the same plane. This is also a post-processing technique, not a real time technique. As paragraph [0055] goes on to describe, a number of different MPR planes 204,206,208 passing through the apex of the heart are addressed and used as described in paragraph [0056] to fill in blocks of a bullseye scorecard 210. In Chenal et al. the volumetric data block is of motional data, not anatomical data, and it is this motional data which is used to fill in the scorecard 210 to give an assessment of regional wall motion. Thus it is seen that there is no repetitive acquisition of two intersecting planes at the same time during a heart cycle, nor the use of an automated processor to define borders in such image pairs during that heart cycle, nor the producing of volume measures of the heart during that heart cycle. Chenal et al. use their techniques for post-processing previously acquired and stored cardiac loops, which are processed and then re-displayed with borders drawn over them. There is no showing or suggestion of the real time method for displaying measures of heart volume as called for by Claim 1. For all of these reasons it is respectfully submitted that Chenal et al. cannot anticipate amended Claim 1 and its dependent Claims 2-10.

Amended Claim 11 describes a method for ultrasonically measuring the volume of a volumetric object of a body comprising acquiring a sequence of ultrasonic images of the heart in real time during a heart cycle in two intersecting image planes at substantially the same time with an ultrasound probe; using an automated processor to define corresponding object borders in the ultrasonic images during the heart cycle; and producing a real time graphical model of a volumetric region of the heart using the defined object borders. An embodiment of the present invention, by acquiring pairs of simultaneous intersecting image planes in read time and defining heart borders during the same heart cycle, can produce a real time graphical model of a heart volume which dynamically presents a model of the beating heart as its motion occurs. As previously mentioned, Chenal et al. apply border detection to previously acquired loops of single images, not pairs of intersecting planes, and thus do not do real time display. Chenal et al. only display heart motion after the fact, after an image loop has been processed and is replayed. The Examiner points to paragraph [0053] of Chenal et al. as teaching a graphical model of a volumetric object, but it is seen that this paragraph produces endocardial surfaces in post-processing, not real time. The paragraph

states that "FIG. 15a represents the three dimensional endocardial surface traced at one phase of the heart cycle." It also says that "Thus a different border surface 200 can be computed for each three dimensional image in the loop." Chenal et al. are operating on previously stored image data, not on pairs of real time intersecting mage planes as called for by Claim 11. Chenal et al. do not produce a real time graphical model of a volumetric region of the heart as called for by Claim 11. For these reasons it is respectfully submitted that Chenal et al. cannot anticipate amended Claim 11 and its dependent Claims 12-17.

Claim 13 was rejected under 35 U.S.C. §103(a) as being unpatentable over Chenal et al. Claim 13 depends from Claim 11, which calls for acquiring a sequence of ultrasonic images in real time of intersecting planes of the heart, which is not shown or suggested by Chenal et al. Claim 11 also calls for using an automated processor to define borders in the pairs of intersecting image planes during the heart cycle of acquisition, which is also not shown or suggested by Chenal et al., which is concerned with the post-processing of previously acquired and stored loops of single image planes. Chenal et al. also do not show or suggest producing a real time graphical model of a volumetric region of the heart as called for by Claim 11. Since Claim 13 depends from Claim 11 and Chenal et al. is lacking all of these element, it is respectfully submitted that Claim 13 is patentable over Chenal et al.

The prior art made of record and not relied upon has been reviewed and is not believed to affect the patentability of the claims discussed above.

In view of the foregoing amendments and remarks, it is respectfully submitted that Claims 1-17 are not anticipated by and are patentable over Chenal et al. Accordingly it is respectfully requested that the rejection of Claims 1-12 and 14-17 under 35 U.S.C. §102(b) and of Claim 13 under 35 U.S.C. §103(a) be withdrawn.

In light of the foregoing amendment and remarks, it is respectfully submitted that this application is now in condition for allowance. Favorable reconsideration is respectfully requested.

Respectfully submitted,

IVAN SALGO

By: /W. Brinton Yorks, Jr./
W. Brinton Yorks, Jr.
Reg. No. 28,923

Philips Electronics
22100 Bothell Everett Highway
P.O. Box 3003
Bothell, WA 98041-3003
(425) 487-7152
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